REMARKS

STATUS OF THE CLAIMS

[0001] Claims 1-22, 24-26 and 28 are pending. The Final Office Action mailed October 31, 2007 (hereinafter "Office Action") rejected Claims 1-13, 15-26, and 28 under 35 U.S.C. § 103(a) as being anticipated by Dunham, et al., U.S. Patent No. 6,269,431 B1 (hereinafter "Dunham") in view of Manley, U.S. Patent Publication No. 2003/0182325 (hereinafter "Manley"). The Office Action rejected Claim 14 under 35 U.S.C. § 103(a) as being anticipated by Dunham and Manley as applied to Claim 12 and in further view of Asano, et al., U.S. Patent Publication No. 2003/0191909 (hereinafter "Asano"). Claim 23 has been cancelled.

[0002] Many of the following arguments are reasserted from the last office action. Responses to the Examiner's arguments are also included.

REJECTION OF CLAIMS 1-13, 15-26, AND 28 UNDER 35 U.S.C. §103(a)

[0003] The Office Action rejected Claims 1-13, 15-26, and 28 under 35 U.S.C. § 103(a) as being unpatentable over Dunham in view of Manley. The Applicants respectfully traverse this rejection. The Examiner bears the initial burden of establishing a *prima facie* case of obviousness. MPEP at § 2142. The prior art reference (or references when combined) must teach or suggest all the claim limitations. MPEP at § 2142. In addition, even if all the claim limitations are taught or suggested by the prior art references, there must be some suggestion or motivation to combine reference teachings to establish obviousness. MPEP §2142. Obviousness may be rebutted by showing that "the art, in any material respect, teaches away from the claimed invention." MPEP at § 2144.05.III. "A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant. The degree of teaching away will of course depend on the particular facts; in general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant." *United States v. Adams*, 383 U.S. 39, 52, 148 USPQ 479, 484 (1966). The Applicants respectfully assert

that Dunham and Manley singly or combined fail to teach or disclose each element of the claimed invention as required under 35 U.S.C. § 103(a). The Applicants assert that there is no motivation, suggestion, or teaching in either Dunham or Manley to combine the references. The Applicants also assert that Dunham teaches away from the Applicants' claimed invention, and teaches away from combination with Manley for the purpose of incorporating incremental backup since Dunham promotes non-incremental backup on a block of backup volumes that are all physically together for its attendant virtues.

[0004] With regard to Claim 1, the Office Action states that Dunham teaches "a storage pool management module (backup agent – Fig. 1, element 25) configured to monitor available storage capacity of the virtual volume and to change the storage capacity in response to the storage management policy and the available storage capacity (the backup agent responds to a request made by the host for a backup routine (i.e. change in storage capacity). The backup monitors the capacity by checking if any spare storage is available – Fig. 15 flow chart, col. 21, lines 16-63), wherein changing the storage capacity comprise allocating and de-allocating a storage volume to the virtual volume in response to the change to the storage capacity (Fig. 15, if a spare volume is available, the next virtual volume will be assigned to it – col. 21, lines 16-63). Note additionally Dunham teaches de-allocating volumes in the storage after modification access – col. 6, line 33 through col. 7, line 17." Office Action at p. 3. The Applicants continue to disagree.

[0005] Dunham teaches allocating spare primary storage capacity during a restore operation, Dunham at col. 18, ll. 27-33, col. 21, ll. 16-26, Fig. 15, steps 241, 242, and then copying a backup volume to the spare capacity of the primary volume, *id.* at col. 7, ll. 47-50, col. 18, ll. 27-33, col. 21, ll. 64-66, Fig. 15, step 244, and then assigning a *new* virtual volume number to the backup copy stored in the spare capacity of the primary volume. *Id.* at col. 21, ll. 20-63. The Applicants respectfully assert that Dunham does not teach changing the storage capacity of a virtual storage volume but instead teaches *assigning a new virtual volume number* (i.e., the next available virtual volume number) to the spare primary volume. *Id.* at col. 18, ll. 27-33, col. 21, ll. 16-26, Fig. 15, steps 241, 242. Dunham does not teach increasing storage capacity

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of any virtual volume by adding volumes from a storage pool. *See generally id.* Claim 1 recites allocating spare storage volumes to increase the capacity of the virtual volume that stores incremental storage data, not adding or creating a new virtual volume, as does Dunham.

[0006] Manley does not supply the lackings of Dunham. In particular, Manley Manley is relied upon for its teaching of incremental backup. However, Manley does not teach or suggest that the incremental backup is achieved in "virtual volumes" or that incremental backup is achieved by changing the storage capacity through allocating and de-allocating a storage volume to a virtual volume in response to the change to the storage capacity. Rather, Manley's teachings differ from the instant invention. Manley assigns new volume numbers within a conventionally provided physical set of storage volumes of a set capacity in the event that additional volumes are added. That is, Manley creates new volumes as needed within a set of available volumes. The storage for the incremental backup of Manley is conventional backup storage that is physically together and does not include virtual volumes. Nowhere does Manley teach dynamically allocating and de-allocating a storage volume in response to the change to the available storage capacity as required by claim 1. Therefore, even if Manley could be combined with Dunham, the combination would not result in the invention of claim 1. Also, it appears that Manley initially allocates a set amount of storage space and does not suggest any need to expand and contract storage volume capacity, as is done in conventional approaches.

[0007] The Examiner responds by stating that "Dunham does in fact clearly disclose 'wherein changing the storage capacity comprises dynamically allocating and de-allocating a storage volume of the storage pool to the virtual volume in response to the change to the storage capacity' as required by the claim. More specifically, referring to the following diagram illustrated by Fig. 15, elements 241, 242, and 243, Dunham teaches allocating a spare volume, and subsequently writing to the volume. Allocating and writing to a volume decreases the effective amount of total capacity of that particular volume, hence the capacity has changed. Additionally it is worthy to note Applicant's argument that 'Dunham does not teach increasing storage capacity of any virtual volume by adding volumes from a storage pool' is not persuasive, and it is not commensurate with the scope of the claim limitation (i.e. lines 12-15 of claim 1),

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which requires simply changing the capacity via dynamic allocation and deallocation functions." Office Action at pp. 19-20. The Applicants disagree.

[0008] The key difference between Claim 1 and Dunham is that Dunham teaches allocating storage devices of a physical volume and, as each storage device is allocated, it is assigned a *new* virtual volume number, thus creating a *new* virtual volume. (See Dunham at Fig. 15, col. 21, ll. 29-33.) There is no teaching that the newly allocated spare volume is added to an *existing* virtual volume. The capacity of virtual volumes is not changed; as new physical devices are allocated, new virtual volumes are created. Claim 1, on the other hand, allocates physical volumes to increase the size of the *existing virtual volume* and deallocates physical volumes to decrease the size of the *existing virtual volume*.

[0009] Likewise, Manley's teachings differ from the instant invention. Manley assigns new volume numbers in the event that additional volumes are added. That is, Manley creates new volumes as needed. Nowhere does Manley teach dynamically allocating and de-allocating a storage volume in response to the change to the available storage capacity as required by claim 1. Rather, Manley's disclosure implies that sufficient backup storage exists in his system such that dynamically allocating and de-allocating in response to available storage capacity is not an issue. Furthermore, Manley does not teach or suggest that his backup volumes are virtual volumes.

[0010] The Examiner states that the Applicant's statement, "Dunham does not teach increasing storage capacity of any virtual volume by adding volumes from a storage pool," is not persuasive and is not commensurate with the scope of the claim limitations. Office Action at pp. 19-20. The Applicants disagree. Claim 1 positively recites "dynamically allocating and de-allocating a storage volume of the storage pool to the existing incremental backup *virtual volume*." *Adding or creating new virtual volumes in primary storage is not equivalent to increasing the capacity of an existing virtual volume as taught and claimed in the present application.*

[0011] The term "virtual volume" is a common term in the art and one of ordinary skill clearly understands that a virtual volume maps virtual addresses to storage addresses. This idea is supported by the specification as well as in the prior art. Dunham teaches that a spare volume

is assigned to the next virtual volume number. Dunham at Fig. 15, col. 21, ll. 29-33. Clearly Dunham also understood a virtual volume to be a mapping to a physical device or volume. With that said, Dunham teaches backing up an entire volume, and when restored, creating a *new* virtual volume for the spare volume upon which the full backup copy has been restored. There is no mention of expanding a current virtual volume with a spare volume. Even taking the broadest view of an existing virtual volume increasing from zero physical volumes to one or more physical volumes, Dunham does not teach this concept, but instead teaches creating a *new* virtual volume by "assign[ing] the next virtual volume number for the host process to the allocated spare volume." Dunham at col. 21, ll. 30-31.

[0012] Manley likewise creates new storage volumes as needed for an incremental backup process instead of allocating and de-allocating among existing storage volumes. Furthermore, Manley does not teach or suggest that his newly created volumes are virtual volumes as required by claim 1.

[0013] The Applicants respectfully assert that Dunham and Manley do not teach de-allocating a storage volume of the storage pool of the virtual storage volumes as recited in Claim 1. Instead, Dunham teaches de-allocating the spare storage volume on the primary storage where the backup data was copied when the virtual volume mapped to the backup data is no longer required and also releasing the virtual volume number and spare capacity for future use. *Id.* at col. 22, ll. 59-65. Manley likewise falls short because Manley makes no mention of virtual volumes and assigns new numbers to create new storage volumes as needed.

[0014] Dunham also teaches in a separate, unrelated de-allocation that during a backup operation for a log-structured file system, new data is copied to a new location in the primary storage while the old data remains in its current location. *Id.* at col. 6, ll. 33-46. A snapshot of the old data is then copied to the secondary storage volume while the new data is concurrently copied to the new location on the primary volume. *Id.* at col. 46-58. Once the snapshot of the old data is copied to the secondary storage, the primary volume that the old data occupied on the primary volume is de-allocated and becomes available to store other data. *Id.* at col. 6, l. 58 to col. 7, l. 17. This de-allocation is unrelated to the allocation of spare primary storage mentioned

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in the restore process and the virtual volume number assigned during the restore process is unaffected by the de-allocation during backup for a log-structured file system. In addition, this de-allocation taught by Dunham does not de-allocate storage volumes to reduce capacity of the virtual volume storing incremental storage data as required in Claim 1.

[0015] The Examiner responds by stating that this argument "is not persuasive, as Examiner maintains that Dunham does in fact teach 'de-allocating a storage volume of the storage pool of the virtual storage volume' as required by claim 1. More specifically, during the backup process as disclosed by Dunham in col. 6 line 33 through col. 7, line 17, once the data is written to the storage pool (i.e. a particular volume), that capacity of that volume is no longer available to the pool, hence it has been deallocated. This reasoning is consistent with Examiner's broadest reasonable interpretation of the claim in light of Applicant's specification pursuant to MPEP § 2111." Office Action at p. 20. The Applicants disagree.

[0016] Claim 1 recites that *one* virtual volume, the existing incremental backup virtual volume, has its capacity changed by allocating and deallocating a storage volume of the storage pool. While the Applicants do not disagree that Dunham teaches deallocating storage volumes, Dunham does not teach that the same virtual volume that has physical volumes deallocated also is allocated virtual volumes. Dunham instead teaches that after a volume has been deallocated, the virtual volume number is released. Dunham at col. 22, ll. 59-65. Dunham teaches temporarily creating virtual volume that is then released when a restore operation is complete. Dunham does not teach monitoring storage capacity of a virtual volume – which implies that the virtual volume exists – then allocating storage volume to it. Instead Dunham teaches creating a *new* virtual volume of a suitable size for the restoration and then releasing the virtual volume once the restoration is complete. Even under its broadest interpretation, Dunham does not teach all of the limitations of Claim 1.

[0017] Manley teaches changing or updating a replicated destination file system snapshot by using a temporary or purgatory directory so that any modified and deleted files may be associated with the purgatory directory until they are restored and reused. In Manley, an inode map is established that maps source inode numbers to destination inode numbers to facilitate

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building of the destination tree using inode/generation number tuples. The inode map allows resynchronization of the source file system to the destination. See the Abstract of Manley. This apparently has the effect of changing the stored data incrementally. It also has the effect of creating new storage volumes, and Manley does not teach that these newly created volumes are virtual volumes. On the other hand, there is no teaching or suggestion in Manley to expand or contract a virtual volume by dynamically allocating or de-allocating a storage volume of the storage pool as required by claim 1.

[0018] The Office Action also states that "[i]t would have been obvious to one of ordinary skill in the art at the time of the invention for Dunham to further include Manley's asynchronous mirroring of snapshots into his own virtual storage system." Office Action at p. 4. The Applicants disagree. The Applicants respectfully assert that Dunham teaches away from an incremental storage system of any type. Dunham specifically and exclusively teaches backing up only an entire logical data structure corresponding to a physical storage unit even when only a file, directory, etc. has been requested for backup. *Id.* at col. 11, l. 49 to col. 12, l. 39. Dunham also teaches away from backing up anything less than an entire physical storage unit. *Id.* at col. 11, ll. 49-64, col. 13, ll. 22-38. Given the teachings of Dunham, one of skill in the art would be led away from any incremental backup taught by Manley. The Applicants respectfully suggest that combining Dunham with any prior art that teaches an incremental backup system is improper because Dunham does not teach, suggest in any way open the door for an incremental backup system and, in fact, teaches away from an incremental backup.

[0019] The Examiner responds to Applicants arguments against the motivation to combine by simply stating it would be obvious to one of ordinary skill to combine Dunham with the asynchronous mirroring of Manley to have a more efficient snapshot mechanism. Office Action at p. 21. The Applicants assert that this argument is made merely though impermissible hindsight by using Claim 1 as a roadmap to find missing elements. This is particularly clear given that one of skill in the art, reading Dunham, would be led in a direction away from incremental backups.

[0020] The Examiner also dismisses the argument that Dunham teaches away from incremental backups stating that "it is in fact Manley, not Dunham that provides suggestion and motivation as to why it would have been obvious for Dunham to incrementally back his system up, rather than relying on copying the entire storage." *Id.* at pp. 21-22. The Applicants disagree. Every application provides justification for the invention and elements of the invention that it teaches. With hindsight, one can always find motivation in for an *element* in an application teaching that *element*. Suggestion and motivation to combine only makes sense in that an application that is missing an element provide some hint, some direction, something that one of skill in the art can latch onto and be directed to another application containing the missing element to *combine* the applications. The MPEP states that the "court emphasized that the proper inquiry is 'whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of ***making the combination***,' . . .." MPEP § 2143.01 (emphasis added). The relevant inquiry is not whether a reference contains something that describes an element, but whether or not there is a motivation for making the combination. The Applicants assert that there is not.

[0021] Furthermore, there does not appear to be a nexus for combining the teachings of Manley with Dunham. The disclosures of Manley and Dunham utilize differing terms and have different goals to the extent that it seems unlikely that the Dunham and Manley would be combined by one of ordinary skill in the art, especially for the purpose of applying incremental backup on a system that is substantially made up by the teachings of Dunham, who teaches away from incremental backup. Thus, the asserted combination would be very unobvious to one of ordinary skill, and would not supply the incremental backup in combination with Dunham's teachings. Manley, on the other hand, does not teach or suggest expanding or contracting an existing virtual volume, which is also missing from Dunham. Therefore, even if the references could be combined, the combination would not result in the claimed invention.

[0022] One of skill in the art reading Dunham would not be motivated to look to incremental backup or to combine with Manley because Dunham teaches away from an incremental backup. "It is improper to combine references where the references teach away from

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their *combination*." MPEP § 2145.X.D.2 *citing In re Grasselli*, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983) (emphasis added). One of skill in the art reading Dunham would not be directed to combine with Manley. The Office Action cites Dunham as containing all of the elements of Claim 1 except the incremental backup. One of skill in the art would not be lead in the direction of Manley because, while it teaches incremental backup, Manley does not teach, disclose, or suggest all of the other elements of Claim 1 or make any suggestion of the elements in Dunham and thus provides no motivation to combine. Simply having an application that includes a missing element and then citing teaching in that application in favor of that element is insufficient as a motivation to combine the two references because it speaks only of the missing element, not of the combination. Combined with the fact that Dunham teaches away from an incremental backup by teaching the virtues of a full backup, the Applicants respectfully assert that there is no suggestion or motivation to combine the references and there is a teaching away from a combination.

[0023] The Applicants respectfully assert that Claim 1 is in condition for allowance. Similarly, the Applicants assert that the arguments in favor of Claim 1 are equally applicable to Claims 16, 24, and 28, which are therefore also in condition for allowance. The Office Action rejected Claim 12 as unpatentable over Dunham and Manley and in further view of Asano. The Applicants disagree. The Applicants respectfully asserts also that the arguments in favor of Claim 1 apply to Claim 12 and that Dunham, Manley, and Asano do not teach the limitations discussed above with respect to Claim 1. The Applicants respectfully assert that Claim 12 is in condition for allowance.

[0024] Claims 2-11, 13-15, 17-22, and 25-26 depend on Claims 1, 12, 16, and 24, respectively. Because the invention of Claims 1, 12, 16, 23, 24, and 28 are not obvious in relation to Dunham and Manley, the Applicants respectfully assert that Claims 2-11, 13-15, 17-22, and 25-26 are similarly in condition for allowance because they depend from allowable claims. *See in re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

[0025] Should additional information be required, the Examiner is respectfully asked to notify the Applicants of such need. If any impediments to the prompt allowance of the claims

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can be resolved by a telephone conversation, the Examiner is respectfully requested to contact the undersigned.

Respectfully submitted,

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